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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 592

Contribution from the States Relations Service
A. C. TRUE, Director

Washington, D. C. PROFESSIONAL PAPER November 5, 1917

COURSES IN SECONDARY AGRICULTURE FOR SOUTHERN SCHOOLS

(THIRD AND FOURTH YEARS)

By

H. P. BARROWS, Specialist in Agricultural Education

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INTRODUCTION.

The following outlines are the result of a demand for a more uniform standard in agricultural instruction in secondary schools of the South. The courses outlined, with other elective courses suggested, are intended for the third and fourth years, after the students have completed the work in agronomy and animal husbandry outlined for the first two years.

ADAPTATION TO LOCAL NEEDS.

It is to be expected that these courses will be molded to meet the needs of the students of each school and the community in which they live. In order to accomplish this purpose it may be necessary to change the order of the courses in the curriculum. To meet the needs of the majority of schools the following order has been suggested: First year, soils and crops; second year, animal husbandry;[2]

[1] Prepared under the direction of C. H. Lane, Chief Specialist in Agricultural Education.

[2] See U. S. Dept. Agr. Bul. 521 for courses for the first and second years.

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third year, horticulture; fourth year, rural economics and farm management and rural engineering. It is not essential that this order shall be maintained in all cases. In districts where fruit growing or vegetable gardening are the predominating agricultural industries, it may be preferable to have horticulture in the first year and let the students learn the fundamentals of plant production in their application to fruit growing, vegetable gardening, and floriculture.

The topics within each course and their order of presentation must be adapted also to meet local needs. It is left with the local teacher to work out a seasonal sequence where such is desired. The teacher also should emphasize topics of local importance at the expense of those not having local value. For example, lesson outlines cover both grapes and strawberries. It may happen that strawberries are very important in a section to which grapes are not suited; as it will not be necessary to spend much time with grapes, more time will be available for strawberries. Likewise, with more comprehensive subjects the needs of the local community should receive the most consideration.

It must be left with the local teacher also to adapt the courses to the individual needs and capacities of his students. Students who have had a course in botany and a course in crop production will be able to go deeper into a subject like plant breeding than will those who are just beginning these studies. Students who have had shopwork in their elementary courses and mathematics and physics in their high-school course will be capable of more advanced work in rural engineering than students without such preparation.

ELECTIVE COURSES.

Although something may be done within a given course to meet the needs of a community or a special group of students, it may be necessary to modify an entire curriculum in order to accomplish this purpose successfully. After the students have a foundation in the fundamentals of crop production and animal husbandry, which are needed in all sections, their work may be conducted along more special lines. While it is presumed that all students will need farm management and rural engineering, the school may not be prepared to do justice to these courses as it would to some other branches of agriculture. Wherever it is possible a number of elective courses should be offered in the third and fourth years. In order to do justice to extra courses, where there is but one teacher, it will be necessary to combine classes and offer some of the courses in alternate years. From the following suggested courses it should be possible to make a selection which will meet most conditions in the South:

Field crops, ½ unit.—A special course in field crops should be an outgrowth of the general course in soils and crops. The course

should be centered around the most important crops in the community. In some sections it may be made largely a course in forage crops, with emphasis on the legumes. In other sections it may be made largely a course in corn or in cotton or both of these crops.

Animal husbandry, ½ unit.—This course should be developed from the general course in animal husbandry and should go into a more detailed and thorough consideration of those phases of animal husbandry most important in the community. In most sections it will be largely a course in meat production, with emphasis on swine and beef cattle.

Dairy husbandry, ½ unit.—A special course in dairying should not be attempted unless there is provision for practical work in the care of milk and the making of butter and cheese. The course should cover milk production as well as the handling of milk and its products. It should be built upon the elementary lessons given in connection with the general course in animal husbandry. At least half the time should be given to practical work in the dairy.

Poultry husbandry, ½ unit.—This course also may be based on the lessons in the animal-husbandry course. A special course not only will give opportunity for a more thorough consideration of those phases of poultry keeping most important in the community, but also time for more practical work.

Dry farming, ½ unit; irrigation farming, ½ unit.—These courses are suggested as a means of adapting the work in agriculture to the arid sections of the Southwest. There are textbooks which may be made the bases for both courses.

Fruit growing, ⅓ unit; vegetable gardening, ⅓ unit; floriculture and landscape gardening, ⅓ unit.—The general course in horticulture outlined in this bulletin may be divided into three special courses as suggested. The course may be given as a whole or in part, according to the needs of the school. If the work in plant propagation is given with the floriculture and home-ground improvement as outlined, each course will constitute a third of a unit.

Farm forestry, ¼ unit.—In many sections a brief course in farm forestry should be given either in addition to the course in horticulture or in substitution for that part not so important in the district. There are good books and bulletins upon which to base the course.

Insect pests, ¼ unit.—In connection with the courses in horticulture and field crops in some sections it will be desirable to give special attention to insect pests. Although, as a means of understanding how to control them, it will be essential to know the structure, habits, and life histories of the insects most important in the district, emphasis should be placed upon control measures.

USE OF REFERENCE MATERIAL.

Although it is left with the teacher and the local school authorities as to whether a textbook is used or not, it is hoped that the outlines, with the references given, will aid the teacher in getting away from the limitations of any one textbook. A list of books suitable for reference purposes is given at the end of each course. By a judicious selection of reference material and the making of special assignments to individual students, the teacher may do much toward adapting the subject to the needs of the community and the members of the class. Special reference to bulletins of the United States Department of Agriculture are given with nearly every lesson. In order to meet local needs, the publications of the States should be used in addition to department publications. It is especially important that the teacher get in touch with the agricultural college, experiment stations, and board of agriculture of the State in which the school is located and learn what material suitable for use in the school may be available. Files of these publications should be kept in working order along with the Yearbooks and the Farmers' Bulletins [1] of the Department of Agriculture.

USE OF ILLUSTRATIVE MATERIAL.

It is important that concrete material shall be brought into the classroom and that well-organized field trips shall be taken when convenient. In addition to such study, abundant use should be made of pictures, charts, lantern slides, etc., to visualize the lesson in an effective manner. Suggestions for illustrative material are given in connection with many of the lessons. The instructor should make preparations early for all illustrative material needed.[2]

PRACTICAL WORK.

In the preparation of the outlines, it has been assumed that there will be in the school year 36 weeks of 5 days each. For each year 104 lessons are planned which provide for classroom work three days in the week, leaving four periods for examinations or reviews. The remainder of the time, equal to two periods per day, two days in the week, should be given to practicums and proj-

[1] Farmers' Bulletin and Yearbooks of the United States Department of Agriculture may be obtained free as long as the supply lasts, on application to the Secretary of Agriculture, Washington, D. C., or to a Senator or Representative in Congress. These and other publications of the Department of Agriculture, when no longer available for free distribution, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a nominal price. Price lists covering various Government publications may be obtained free from the Superintendent of Documents. Each teacher should secure a copy of Price List No. 16, which includes Farmers' Bulletins, Yearbooks, and Department Bulletins of the United States Department of Agriculture. Lists of these publications prepared for teachers may be obtained from the Agricultural Instruction division of the States Relations Service.

[2] See the following Farmers' Bulletins: 586, Collection and Preservation of Plant Material for Use in the Study of Agriculture; 606, Collection and Preservation of Insects and Other Material for Use in the Study of Agriculture.

ects. It is assumed that credit will be given for home projects and practicums on the same basis as for laboratory work, i. e., one hour's credit for two hour's work, and that extra credit will be given for extensive projects requiring more than the time needed to make up the credit given for the course. Routine work involved in a project may not be worthy of full credit. It is expected that extra credit will be given for the projects suggested in connection with the fourth-year courses. It is even more important that the practical work meet the needs of the students and the community than that of the classroom. The practicums and projects listed are but suggestive. Credit should be given for any line of community or home work which may involve the acquiring of skill and in which the principles learned in the classroom may be applied. It is especially important that the teacher make an effort to secure acceptable substitutes for home projects for students who do not live on farms. Credit should be given according to the educational value of such work. In order to have such value, it must present problems new to the student, it should be linked in a definite way with the course taken, and it should have the supervision of the instructor or some competent person.[1]

OUTLINE FOR HORTICULTURE—THIRD YEAR.

(One unit.)

PLANT PROPAGATION.

(Eleven lessons, eight double periods for practical work.)

References.—The Propagation of Plants, Farmers' Bulletin 157. For suggestions as to teaching this subject, with directions for practical work, see States Relations Service Document 63, The Propagation and Pruning of Plants—Suggestions for Teaching the Subject in Secondary Schools.

LESSON 1.—*The Seed.*

1. How plants produce seed.
2. Why plants produce seed.
3. Structure and classification of seeds.

Illustrative material.—Charts and diagrams showing fecundation of the ovule. Flowers and seeds of different types.

LESSON 2.—*Seed Selection.*

1. Factors influencing quality of seed.
2. Importance of seed selection.
3. Gathering and storing seed.
4. Seed buying.

Special references.—The Farmer's Interest in Good Seed, Farmers' Bulletin 111. Articles in the following Yearbooks of the Department of Agriculture: 1896, Seed Production and Seed Saving; 1899, Seed Selling, Seed Growing, and Seed Testing; 1901, Agricultural Seeds, Where Grown and How Handled; 1907, Art of Seed Selection and Breeding; 1915, How Seed Testing Helps the Farmer.

[1] For a discussion of the home-project plan and the problem of giving credit for home work, see the following bulletins of this department: 346, Home Projects in Secondary Courses in Agriculture; 385, School Credit for Home Practice in Agriculture.

EXERCISE 1.—*Examination of Seed for Impurities.*

Special reference.—Testing Farm Seed in the Home and in the Rural School, Farmers' Bulletin 428.

LESSON 3.—*Germination and Testing of Seeds.*

1. Conditions essential to germination.
2. Importance of seed testing.
3. Methods of testing seeds.

Special reference.—Testing Farm Seed in the Home and in the Rural School, Farmers' Bulletin 428.

EXERCISE 2.—*Testing Seeds for Viability.*

NOTE.—If the students have had some practice in testing farm seed, use garden seeds, such as onion, carrot, and parsnip, or flower seeds more difficult to test.

LESSON 4.—*The Hotbed.*

1. Principles and essentials of construction.
2. Materials and methods of construction.
3. Management.

Illustrative material.—Diagrams and plans showing hotbed construction.

EXERCISE 3.—*Hotbed Construction.*

Special reference.—For directions for making a hotbed see Farmers' Bulletin 195, Annual Flowering Plants.

LESSON 5.—*The Seed Bed and Cold Frame.*

1. Purpose of the seed bed.
2. Establishing and maintaining the bed.
3. Seed flats and their use.
4. The cold frame.
5. The lath house.

Special reference.—Frames as a Factor in Truck Growing, Farmers' Bulletin 460.

EXERCISE 4.—*Making and Using Seed Flats, Frames, etc.*

LESSON 6.—*Asexual Propagation.*

1. Underlying principles.
2. Advantages to the farmer.
3. Advantages to the plant breeder.
4. Natural methods.

LESSON 7.—*Propagation by Parts Intact.*

1. Suckers.
2. Stolons.
3. Layers.
4. Division of the crown.

Illustrative material.—Fresh material supplemented by charts to show various means of propagation.

LESSON 8.—*Propagation by Parts Detached.*

1. Specialized buds as bulbs, bulblets, corms, and tubers.
2. Roots.
3. Cuttings of various types.

EXERCISE 5.—*Propagation by Cuttings.*

LESSON 9.—*Budding and Grafting.*

1. Definition.
2. Underlying principles.
3. Essential requisites.

LESSON 10.—*Budding and Grafting*—Continued.

1. Types of budding.
2. Types of grafting.
3. Materials and methods.

EXERCISE 6.—*Field Practice in Budding.*

EXERCISE 7.—*Practice in Simple Types of Grafting.*

LESSON 11.—*Nursery and Orchard Practices.*

1. Methods used in producing nursery stock.
2. Methods used in trying out new varieties.
3. Bridge-grafting wounded trees.
4. Top-working established orchards.

Special references.—Farmers' Bulletin 539, The Propagation of Citrus Trees in the Gulf States. Yearbook 1902, Top-working Orchard Trees.

NOTE.—This lesson may be supplemented to good advantage by a field trip to an orchard or nursery where such work is in progress.

FRUIT GROWING.

(Thirty-five lessons, 12 double periods for practical work. Projects.)

References.—The following Farmers' Bulletins; 113, The Apple and How to Grow It; 154, The Home Fruit Garden, Preparation and Care; 482, The Pear and How to Grow It; 538, Sites, Soils and Varieties of Citrus Groves in the Gulf States; 631, 632, and 633, Growing Peaches; 700, Pecan Culture; 776, Growing Cherries East of the Rocky Mountains. Articles in the following Yearbooks: 1900, Commercial Pear Culture; 1901, The Home Fruit Garden. Commercial Apple Growing; 1902, Cultivation and Fertilization of Peach Orchards.

LESSON 1.—*Factors Determining Success in Fruit Growing.*

1. Relation to general farming and live stock.
2. Climate and weather conditions.
3. Accessibility to markets.
4. The personal factor.

Illustrative material.—Illustrated Lecture on Orchard Management, States Relations Service, Office of Farmers' Institutes.

LESSON 2.—*The Location and Site for the Orchard.*

1. Soils and subsoils.
2. The moisture supply and water drainage.
3. Temperatures and air drainage.
4. Wind protection.
5. Exposure and slope.

LESSON 3.—*Classification of Fruits.*

1. Pome fruits, stone fruits, citrus fruits, and other fruits of the orchard.
2. Small fruits and grapes.
3. Other fruits.

LESSON 4.—*Varieties of Fruits for the South.*

1. Varieties of general importance.
2. Varieties of local importance or value.

Special references.—Fruits Recommended by American Pomological Society for Cultivation in Various Sections of the United States and Canada. Revised by Committee of American Pomological Society. Bureau of Plant Industry Bulletin 151. "Promising New Fruits" in each of the Yearbooks. Apples: Production Estimates and Important Commercial Districts and Varieties, Department Bulletin 485.

LESSON 5.—*Orchard Soils.*

1. Relation of soils to types of fruit.
2. Relation of soils to varieties of fruit.
3. Relation of soils to water supply.
4. Relation of soils to tillage and management.

LESSON 6.—*Preparing the Land.*

1. Necessity of thorough preparation before planting.
2. Lands to be irrigated or needing drainage.
3. Preparation of new lands.
4. Plowing, subsoiling, and other operations.

LESSON 7.—*Laying out the Orchard.*

1. Distances to plant.
2. Systems of orchard planting.
3. The question of interplanting.
4. Staking out the orchard.

Illustrative material.—Charts showing planting systems.

LESSON 8.—*Planting the Trees.*

1. Time of planting.
2. Care of trees before planting.
3. Details which mean much in planting.
4. Planting implements and methods.

EXERCISE 1.—*Planting Orchard Trees.*

On the school farm, the home farm of the students, or upon farms neighboring the school.

LESSON 9.—*Cultivation of the Orchard.*

1. Purposes of tillage.
2. Tillage implements.
3. Methods of cultivation.

LESSON 10.—*Green Manures and Cover Crops.*

1. Clean tillage *v.* sod.
2. Value of special crops for green manuring.
3. The problem of erosion and the use of cover crops.
4. Suitable crops and their management.

LESSON 11.—*Fertilizers.*

1. Effects of fertilizers upon trees and fruits.
2. Use of barnyard manure.
3. Commercial fertilizers and their application.

Illustrative material.—Samples of commercial fertilizers.

LESSON 12.—*Intercropping.*

1. Advantages of intercropping.
2. Dangers of intercropping.
3. Poor crops to grow between trees.
4. Good crops and their management.

LESSON 13.—*Friends and Foes of the Fruit Grower.*

1. Birds in the orchards.
2. Work of the honeybee.
3. Extent of insect injury.
4. Extent of losses from disease.
5. Other orchard pests.

Special references.—The following Farmers' Bulletins: 506, Food of Some Well-known Birds of Forest, Farm and Garden; 630, Some Common Birds Useful to the Farmer; 670, Field Mice as Farm and Orchard Pests; 702, Cottontail Rabbits in Relation to Trees and Farm Crops.

LESSON 14.—*Insect Pests and Their Control.*

1. Classification of insects according to nature of injury and method of control.
2. Control of sucking insects.
3. Control of biting and boring insects.
4. Natural enemies of insects.
5. Value of clean cultivation and sanitation.

Illustrative material.—Mounted insects and specimens showing insect injury.

Special reference.—Collection and Preservation of Insects and Other Materials for Use in the Study of Agriculture, Farmers' Bulletin 606.

EXERCISE 2.—*Mixing Insecticides.*

For spraying exercise to follow. May be necessary to combine Exercises 2 and 3.

LESSON 15.—*Some Common Insect Pests.*

1. Insects attacking the pome fruits.
2. Insects attacking the stone fruits.
3. Miscellaneous insects of importance.

Special references.—The following Farmers' Bulletins: 440, Spraying Peaches for the Control of Brown Rot, Scab, and Curculio; 492, The More Important Insect and Fungus Enemies of Fruit and Foliage of the Apple; 650, San Jose Scale and Its Control; 662, Apple Tree Tent Caterpillar; 675, Round-headed Apple Tree Borer; 723, Oyster-shell Scale and the Scurfy Scale; 845, Gipsy Moth and Brown-tail Moth. The following circulars of the Bureau of Entomology; 20, The Wooly Aphis of the Apple; 54, The Peach Tree Borer; 131, How to Control Pear Thrips. Articles in the following Yearbooks: 1907, Codling Moth or Apple Worm; 1908, Information About Spraying for Orchard Insects; 1913, Bringing Applied Entomology to the Farmer.

EXERCISE 3.—*Spraying for Insect Pests.*

Wherever possible this should be a class practicum upon the school farm or farms neighboring the school. If the school does not own a spraying outfit it may be possible to borrow one. It is preferable to spray where the work is really needed and with a view of accomplishing practical results. If it is impossible to carry out spraying as a class practicum it should be encouraged as a home practicum.

Special reference.—Important Insecticides, Farmers' Bulletin 127.

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LESSON 16.—*Plant Diseases.*

1. Physiological troubles.
2. Fungus parasites.
3. Bacteria and plant disease.

Illustrative material.—Mounted specimens showing plant diseases.

Special reference.—Collection and Preservation of Plant Material for Use in the Study of Agriculture, Farmers' Bulletin 586.

LESSON 17.—*The Control of Plant Diseases.*

1. Value of sanitation and general preventive measures.
2. Disease-resistant varieties.
3. Spraying and pruning as a means of control.

Special references.—The following Farmers' Bulletins: 243, Fungicides and Their Use in Preventing Diseases of Fruits: 284, Insect and Fungus Enemies of the Grape East of the Rocky Mountains; 440, Spraying Peaches for Control of Brown Rot, Scab, and Curculio; 492, The More Important Insect and Fungus Enemies of the Fruit and Foliage of the Apple. Articles in the following Yearbooks: 1895, Cause and Prevention of Pear Blight; 1896, Diseases of Shade and Ornamental Trees; 1908, Development of Farm Crops Resistant to Disease.

EXERCISE 4.—*Mixing Fungicides.*

The suggestions for mixing insecticides and spraying for insect pests will apply to Exercises 4 and 5.

LESSON 18.—*Some Common Diseases of Orchard Fruits.*

1. Diseases attacking the pome fruits.
2. Diseases attacking the stone fruits.
3. Miscellaneous diseases of importance.

Special references.—The following Farmers' Bulletins: 243, Fungicides and Their Use in Preventing Diseases of Fruits; 440, Spraying Peaches for the Control of Brown Rot, Scab, and Curculio; 492, The Important Insect and Fungus Enemies of the Fruit and Foliage of the Apple. Peach Scab and Its Control, Department Bulletin 395.

EXERCISE 5.—*Spraying for Fungus Diseases.*

LESSON 19.—*Frost Protection.*

1. Physics of frost formation.
2. Foretelling frost.
3. Injury due to freezing temperatures.
4. Methods of protection and control.

Special references.—Articles in the following Yearbooks: 1909, Prevention of Frost Injury to Fruit Crops: 1914, Story of the Thermometer and Its Uses in Agriculture. The following Farmers' Bulletins: 104, Notes on Frost: 401, Protection of Orchards in the Pacific Northwest from Spring Frosts by Means of Fires and Smudges.

LESSON 20.—*Principles of Pruning.*

1. A study of fruit buds.
2. Bearing habits of trees.
3. Pruning for wood *v.* pruning for fruit.
4. Pruning tools.

Special references.—Articles in the following Yearbooks: 1895, Principles of Pruning and Care of Wounds in Woody Plants; 1898, Pruning of Trees and Other Plants. Pruning, Farmers' Bulletin 181.

LESSON 21.—*Pruning Young Trees.*

1. Directing the growth.
2. Pruning the young tree which has been neglected.
3. Special directions for forming heads on trees of different types.

EXERCISE 6.—*Pruning Young Trees.*

Inasmuch as pruning is largely an art involving skill to be developed by practice, as much time as possible should be spent in the application of the principles discussed in the classroom in practical work in the orchard. In any fruit-growing community it should not be difficult to secure material for practice near the school. Although the work may be introduced by a demonstration from the instructor and should be supervised closely, its value will depend largely upon the amount of practice secured by each individual student. Usually it is not necessary for the school to own equipment for all the students, as they may bring tools from home. For young trees hand shears will suffice, but for older trees saws, long-handled shears, and ladders also will be needed.

LESSON 22.—*Pruning Trees in Bearing.*

1. Relation of pruning to fruit production.
2. Special directions for pruning different kinds of trees in bearing.

EXERCISE 7.—*Pruning Bearing Trees.*

LESSON 23.—*Renovating Old Orchards.*

1. Possibilities in renovation.
2. Pruning, spraying, scraping, cultivation, and other operations involved.
3. Top-working to change variety.

Special reference.—The Profitable Management of the Small Apple Orchard on the General Farm, Farmers' Bulletin 491.

EXERCISE 8.—*Pruning Neglected Trees.*

LESSON 24.—*Strawberries.*

1. The botany of the strawberry plant.
2. Soils and fertilizers for strawberries.
3. Establishing the strawberry bed.
4. Care and cultivation.

Special references.—The following Farmers' Bulletins: 198, Strawberries; 664, Strawberry Growing in the South.

LESSON 25.—*Bush Fruits.*

1. Raspberries.
2. Blackberries and dewberries.
3. Currants.
4. Gooseberries.

Special references.—The following Farmers' Bulletins: 213, Raspberries; 643, Blackberry Culture; 728, Dewberry Culture. Small Fruit Culture for Market, Yearbook 1895.

LESSON 26.—*Grapes.*

1. Species of grapes.
2. Propagation of the grape.
3. Establishing a vineyard.
4. Care and management.
5. Enemies.

Special references.—Pruning and Training of Grapes, Yearbook 1898. The following Farmers' Bulletins: 118, Grape Growing in the South; 471, Grape Propagation, Pruning, and Training; 709, Muscadine Grapes; 758, Muscadine Grape Sirup.

LESSON 27.—*Picking Fruit.*

1. When to pick.
2. How to pick.
3. Picking equipment.
4. Management of pickers.

EXERCISE 9.—*Picking Fruit.*

The picking, packing, and grading of fruits is another form of practice which must be adapted to community needs and community interests. In one section the work may be centered on strawberries, in another apples, and perhaps in a third it will be citrus fruits. Exercises 9, 10, and 11 may be combined and as much extra time devoted to the work as possible. In this work also demonstrations may very well precede practice. Perhaps some of the students are so skilled that they may show other students how.

Special reference.—Color as an Indication of the Picking Maturity of Fruits and Vegetables, Yearbook 1916.

LESSON 28.—*Grading Fruit.*

1. Necessity for grading.
2. Examples of standard grading.
3. Packages.

Illustrative material.—Charts showing systems of grading and packing.

LESSON 29.—*Packing.*

1. Packing small fruits.
2. Packing apples and pears.
3. Packing plums and apricots.
4. Packing peaches.
5. Packing cherries.

EXERCISES 10 AND 11.—*Grading and Packing Fruits.*

LESSON 30.—*Storing Fruits.*

1. Keeping qualities of fruits.
2. Relation of keeping quality to handling.
3. Advantages in storing.
4. Essentials of good storage.
5. Types of storehouses.

Special reference.—Cold Storage of Small Fruits, Bureau of Plant Industry Bulletin 108.

LESSON 31.—*Transportation of Fruits.*

1. Relation of distance of market to type of fruit growing.
2. Facilities for quick handling.
3. Hauling to near-by markets.
4. Express shipments.
5. Loading cars.
6. Precooling and refrigeration.

LESSON 32.—*Marketing.*

1. The fruit market as it now exists.
2. Building up a private trade.
3. Cooperative marketing.
4. Advertising.

Special references.—Handling and Shipping Citrus Fruits in the Gulf States, Farmers' Bulletin 696. Articles in the following Yearbooks: 1905, Handling of Fruit for Transportation; 1910, Cooperation in Handling and Marketing Fruit; 1910, Precooling of Fruit.

EXERCISE 12.—*A Fruit Exhibit. Judging Fruits.*

Special references on plant breeding.—The following Bulletins of the Bureau of Plant Industry: 167, New Methods of Plant Breeding; 165, Application of Some of the Principles of Heredity to Plant Breeding. Articles in the following Yearbooks: 1897, Hybrids and Their Utilization in Plant Breeding; 1898, Improvement of Plants by Selection; 1899, Progress of Plant Breeding in the United States; 1901, Progress in Plant and Animal Breeding; 1910, New Methods of Plant Breeding; 1911, Plant Introduction for the Plant Breeder.

LESSON 33.—*Improvement of Fruits.*

1. Law of variation.
2. Law of heredity.
3. Selection—natural and artificial.

LESSON 34.—*Improvement of Fruits*—Continued.

1. Methods of increasing variation.
2. Selection according to ideals.
3. Testing hereditary powers.
4. Relation to methods of propagation.

LESSON 35.—*Improvement of Fruits*—Continued.

1. Some things which have been accomplished by plant breeders.
2. Future possibilities.
3. Work of farmer *v.* work of specialist.

Suggested Home Projects—

1. Care and management of bearing orchard.
2. Establishing of home orchard.
3. Renovation of old orchard.[1]
4. Ridding orchards of insect pests and diseases.
5. Top-working trees to more desirable varieties.
6. Harvesting and marketing fruit crops.
7. Production projects with strawberries and other small fruits.

Suggestions for Group Projects—

If the school owns a farm upon which an orchard is located, the class in fruit growing might be given the care and management of the school orchards as a means of applying their classroom instruction and for securing practical experience upon which to base the instruction of the classroom. Some successful schools which have not owned orchards have leased neighboring orchards and turned their management over to the students in horticulture, who did all the

[1] See Department Bulletin 346, Home Projects in Secondary Courses in Agriculture, for outline of this project.

work under the direction of the teacher. As the class was responsible for the success of the project, financially and otherwise, such an undertaking proved an excellent method of developing cooperation and group action among the students.

HOME FLORICULTURE.

(11 lessons. Projects.)

Reference.—See States Relations Service Document 54, Home Floriculture—Suggestions for Teaching the Subject in Secondary Schools.

This document gives an outline for a home flower garden project and suggestions for practicums. Although no time is allowed in this outline for practice, it may be possible in some cases to take more time for this work at the expense of some other part of the course not so important in the community.

LESSON 1.—*How Plants Grow.*

1. Requirements of the plant.
2. Work of roots, stems, and leaves.
3. The blooming of plants.

LESSON 2.—*How We May Aid Plants in Growing.*

1. Meeting requirements for food, water, air, light, and proper temperature.
2. Protection from enemies.

LESSON 3.—*Soils and Fertilizers for Flowering Plants.*

1. Ideal garden soils.
2. Modifying unsuitable types.
3. Bedding and potting soils.
4. Natural manures—the compost heap.
5. Commercial fertilizers.

LESSON 4.—*Treatment for Insects and Disease.*

1. Classes of insects and their injury.
2. Methods of insect control.
3. Types of plant disease.
4. Control of disease.

Illustrative material.—Specimens of insects and plant diseases affecting flowering plants.

LESSON 5.—*Annuals.*

1. The plants.
2. Their management.

Special reference.—Annual Flowering Plants, Farmers' Bulletin 195.

Illustrative material.—In considering the various classes of flowering plants fresh material from the garden should be used where it may be obtained. Good illustrations, such as found in magazines and the best catalogues, should be used in a supplementary way.

LESSON 6.—*Potting and Bedding Plants.*

1. Plants suitable for potting.
2. Potting the plants.
3. Management of potted plants.

LESSON 7.—*Herbaceous Perennials.*

1. The plants.
2. Their management.

LESSON 8.—*Bulbs.*

1. The plants.
2. Their management.

LESSON 9.—*Roses and Other Woody Perennials.*

1. Types and varieties of roses.
2. Management of roses.
3. Other woody perennials of local importance.

Special reference.—Roses for the Home, Farmers' Bulletin 750.

LESSON 10.—*Window Gardening.*

1. The essentials of a window box.
2. Making window boxes.
3. Suitable plants and their management.

Illustrative material.—There are great possibilities in the use of window boxes to furnish living material for a study of plants in the classroom.

LESSON 11.—*The Home Flower Garden.*

1. Purpose of the garden.
2. Location.
3. Plans.
4. Management.

Suggested projects.—

1. Care and management of home flower garden.
2. Contests in growing special plants suited to locality.
3. Producing plants or flowers for sale.
4. Trying out plants little known in community.
5. An exhibit of flowers grown.

HOME-GROUND IMPROVEMENT.

(11 lessons. Projects.)

References.—Beautifying the Home Grounds, Farmers' Bulletin 185. See States Relations Service Document 54, Improving the Home Grounds—Suggestions for Teaching the Subject in Secondary Schools, for directions for practicums and projects to accompany these lessons. A project-study outline is given.

LESSON 1.—*Landscape Art Applied to the Home.*

1. Principles same as applied to large areas.
2. The fundamentals of landscape art.
3. Horticultural knowledge required.

Illustrative material.—Photographs and pictures from magazines will do much toward establishing ideals in landscape art in the minds of the students.

LESSON 2.—*Planning the Home Grounds.*

1. Ideal plans.
2. Meeting existing conditions.
3. Country *v.* city homes.

Illustrative materials.—Charts and blackboard diagrams showing plans should be used in connection with this lesson. Illustrated lecture, Farm Home Grounds: Their Planting and Care, States Relations Service, Office of Farmers' Institutes.

LESSON 3.—*Beds, Walks, and Drives.*

1. Place in the plan.
2. Construction and management.

LESSON 4.—*Lawns.*

1. Lawn soils and fertilizers.
2. Grasses for lawns.
3. Establishing the lawn.
4. Maintaining the lawn.

Special reference.—Lawn Soils and Lawns, Farmers' Bulletin 494.

LESSON 5.—*Deciduous Trees.*

1. Place of trees on the home grounds.
2. Kinds of trees adapted to local condition.
3. Planting shade trees.
4. Care and management.

Special reference.—Practical Tree Surgery, Yearbook 1913.

LESSON 6.—*Evergreens.*

1. Place of evergreens on the home grounds.
2. Broad-leaved evergreens.
3. The conifers.
4. Planting and management.

LESSON 7.—*Shrubs.*

1. Place of shrubs on the home grounds.
2. Kind of shrubs adapted to local conditions.
3. Planting and management.

LESSON 8.—*Vines.*

1. Place of vines on home grounds.
2. Annual vines.
3. Perennial vines.
4. Planting and management.

LESSON 9.—*Hedges, Shelter, and Windbreaks.*

1. Place on the home grounds.
2. Suitable shrubs and trees.
3. Planting and management.

LESSON 10.—*Temporary v. Permanent Effects.*

1. The new home—getting quick results.
2. Use of quick-growing annuals.
3. Rapid-growing soft wood trees.
4. Replacing with more enduring forms.

LESSON 11.—*The School Grounds.*

1. Need for school-ground ornamentation.
2. School grounds *v.* the home grounds.
3. Planting and managing the school grounds.

Special reference.—Tree Planting on Rural School Grounds, Farmers' Bulletin 134.

Suggested projects.—

1. Ornamenting home grounds completely or in part as: Front and back yard improvement, planting trees, shrubs, hedges, lawns or beds of flowers.
2. Community improvement campaign.
3. Ornamentation of school grounds.

VEGETABLE GARDENING.

(35 lessons. Projects.)

References.—The following Farmers' Bulletins: 255, The Home Vegetable Garden; 647, The Home Garden in the South. Articles in the following Yearbooks: 1900, Development of Trucking Interests; 1907, Truck Farming in Atlantic Coast States.

LESSON 1.—*Types of Vegetable Gardening.*

1. The home vegetable garden.
2. Market gardening.
3. Truck farming.
4. Seed growing.

LESSON 2.—*Factors Which Influence the Growing of Vegetables.*

1. Relation to general farming.
2. Climate and weather conditions.
3. Accessibility to markets and transportation facilities.
4. The personal factor.

LESSON 3.—*Soils and Their Treatment.*

1. Types of soils best suited for vegetables.
2. Improvement of heavy soils.
3. Improvement of light soils.
4. Preventing erosion.

LESSON 4.—*Barnyard and Green Manures.*

1. Value of organic matter.
2. Care and use of barnyard manure.
3. Management of green-manuring crops.

Special references.—The following Farmers' Bulletins: 192, Barnyard Manure; 278, Leguminous Crops for Green Manuring.

LESSON 5.—*Commercial Fertilizers.*

1. Conditions making use essential and profitable.
2. Buying and mixing of fertilizers.

LESSON 6.—*Garden Tools and Implements.*

1. Tools for preparation.
2. Hand tillage tools.
3. Horse-drawn tillage implements.
4. Planting machines.
5. Harvesting machines.
6. The tool house—care of implements.

Illustrative material.—Implement catalogues. Visit to implement dealer if possible.

LESSON 7.—*Seeds.*

1. Importance of good seed.
2. Viability in relation to age.
3. Germination temperature in relation to time of planting.
4. Testing seeds.

Illustrative material.—Seed catalogues, samples of garden seed.

LESSON 8.—*Seed Growing and Buying.*

1. Home-grown seed.
2. Specialized seed growing.
3. Buying seed.

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Special references.—Farmers' Bulletin 884, Saving Vegetable Seeds for the Home and Market Garden. Production of Vegetable Seeds, Bureau of Plant Industry Bulletin 184. Articles in the following Yearbooks: 1896, Seed Production and Seed Saving; 1899, Seed Selling, Seed Growing and Seed Testing; 1901, Agricultural Seeds, Where Grown and How Handled; 1907, Art of Seed Selection and Breeding; 1909, Vegetable Seed Growing as a Business.

LESSON 9.—*Improvement of Varieties.*

1. Work of seed growers and special plant breeders.
2. Selection in connection with home-grown seed.
3. Novelties *v.* proven varieties.
4. Study of seed catalogues.

Special reference.—Testing Commercial Varieties of Vegetables, Yearbook 1900.

LESSON 10.—*General Cultural Methods.*

1. Preparation of the seed bed.
2. Planting methods.
3. Conservation of moisture.
4. Combating weeds.

LESSON 11.—*Garden Insects.*

1. Damage done by insects.
2. Common biting insects of the garden.
3. Common sucking insects of the garden.

Illustrative material.—Specimens of common garden insects.

LESSON 12.—*Control of Insect Pests.*

1. Poison sprays.
2. Contact sprays.
3. Control by rotation.
4. Other means of control.

LESSON 13.—*Control of Diseases.*

1. Nature of plant diseases.
2. Control by spraying.
3. Control by rotation.
4. Other means of control.
5. Disease-resistant varieties.

Illustrative material.—Specimens of diseases of garden crops.

Special references.—The following Farmers' Bulletins: 232, Spraying for Cucumber and Melon Diseases; 488, Diseases of Cabbage and Related Crops and Their Control; 544, Potato Tuber Diseases; 714, Sweet Potato Diseases.

LESSON 14.—*Harvesting and Marketing.*

1. Harvesting of the green crops.
2. Harvesting of matured products.
3. Harvesting devices and machinery.
4. Transportation of vegetables.
5. Establishing a private trade.
6. Cooperative marketing.

Special reference.—A Successful Method of Marketing Vegetable Products, Yearbook, 1912.

LESSON 15.—*Storing Vegetables.*

1. Keeping qualities of vegetables.
2. Essentials of good storage.
3. Devices for storing in the field.
4. The storage house.

LESSON 16.—*Sweet Potatoes.*

1. Botany of the plant.
2. Types and varieties.
3. Soils and fertilizers.
4. Propagation and planting.
5. Cultivation and management of crop.
6. Storage and handling of crop.

(The above outline may be adapted to the crops following.)

Special references.—The following Farmers' Bulletins: 324, Sweet Potatoes; 548, Storing and Marketing Sweet Potatoes; 714, Sweet Potato Diseases.

Illustrative material.—Illustrated lecture, The Sweet Potato: States Relations Service, Office of Farmers' Institutes.

LESSON 17.—*Root Crops.*

1. Radishes.
2. Turnips and rutabagas.
3. Beets.

LESSON 18.—*Root Crops.*

1. Salsify.
2. Carrots.
3. Parsnips.
4. Other roots of local importance.

LESSON 19.—*Irish Potatoes.*

Special references.—The following Farmers' Bulletins: 407, The Potato as a Truck Crop; 533, Good Seed Potatoes and How to Produce Them; 753, Commercial Handling, Grading, and Marketing of Potatoes.

LESSON 20.—*Onions.*

Special references.—The following Farmers' Bulletins: 354, Onion Culture; 434, The Home Production of Onion Seed and Sets.

LESSON 21.—*Cabbage and Its Relatives.*

1. Cabbage and collards.
2. Cauliflower.
3. Kohl-rabi.
4. Brussels sprouts.

Special reference.—Cabbage, Farmers' Bulletin 433.

LESSON 22.—*Plants for Greens and Garnishing.*

1. Kale.
2. Turnips.
3. Mustard.
4. Spinach.
5. Swiss chard.
6. Dandelions.
7. Parsley.
8. Cress and other crops of minor or local importance.

LESSON 23.—*Lettuce and Endive.*

Special reference.—American Varieties of Lettuce, Bureau of Plant Industry Bulletin 69.

LESSON 24.—*Celery.*

Special reference.—Celery, Farmers' Bulletin 282.

LESSON 25.—*Tomatoes, Peppers, and Eggplant.*

Special references.—The following Farmers' Bulletins: 220, Tomatoes; 642, Tomato Growing in the South.

LESSON 26.—*Watermelons.*

LESSON 27.—*Cantaloups and Muskmelons.*

LESSON 28.—*Cucumbers and Squashes.*

Special references.—The following Farmers' Bulletins: 254, Cucumbers; 231, Spraying for Cucumber and Melon Diseases.

LESSON 29.—*Sweet Corn and Popcorn.*

Special references.—The following Farmers' Bulletins: 553, Popcorn for the Home; 554, Popcorn for the Market.

LESSON 30.—*Some Southern Vegetables.*

1. Okra.
2. Globe artichoke.
3. Roselle.

Special references.—The following Farmers' Bulletins: 232, Okra: Its Culture and Uses; 307, Roselle: Its Culture and Uses.

LESSON 31.—*Asparagus and Rhubarb.*

LESSON 32.—*Peas and Beans.*

Special reference.—Beans, Farmers' Bulletin 289.

LESSON 33.—*The Farmers' Vegetable Garden.*

1. Importance of producing vegetables for the home.
2. Plans in relation to economical management.
3. Management.

Illustrative material.—Illustrated lecture, The Home Vegetable Garden, States Relations Service, Office of Farmers' Institutes.

LESSON 34.—*The Suburban Garden.*

1. Kinds of vegetables.
2. Plans in relation to available space.
3. Management.
4. The garden in town and village.

LESSON 35.—*Forcing Vegetables.*

1. The hotbed.
2. Cold frames.
3. Sundry devices.

Special reference.—Frames as a factor in Truck Growing, Farmers' Bulletin 460.

SUGGESTED PROJECTS FOR HORTICULTURE.

SCHOOL GARDEN.

1. Wherever the home vegetable garden needs exploitation, the school garden might well be made a model home garden.

2. It may be used for the introduction of new varieties and that students and patrons may secure a wider knowledge of vegetable farms.

3. It may be used to supply vegetables and fruits for the domestic-science work, especially in connection with canning practice.

HOME GARDENS.

1. Care and management of home vegetable garden.
2. Production projects with acre or less of crop suitable to locality and for which there is a ready market.
3. Correlation with canning-club work.
4. Improvement of varieties by seed selection.
5. Seed-growing experiments.
6. Variety tests.
7. Control of insects and disease.
8. Production and sale of plants grown in hotbeds, etc.
9. Developing city trade through parcel post.
10. An exhibition of products grown.

EQUIPMENT FOR HORTICULTURE.

As the laboratory work in horticulture is essentially of a practical nature in which the exercises are adapted to local conditions, no definite list of apparatus and materials is possible. The work should be adapted to the resources of the school as well as to its needs. The school which owns a well-equipped farm with greenhouse, orchard, and garden will have the advantage; however, no school need neglect practical work because it does not have equipment, as it may use the home farms of the students and the farms surrounding the school.

Each school should make an effort to secure the following equipment for the exercises suggested in the outline:

Materials for hotbed, cold frames, seed flats, and window boxes.

Budding knives, grafting chisel, pruning saws, and shears.

Material for making grafting wax.

A spraying outfit with spraying materials for insect pests and plant diseases.

A collection of vegetable and flower seeds, with blotters and paper pie plates to be used in testing.

TEXTS AND REFERENCES FOR HORTICULTURE.[1]

Bailey, L. H. Manual of Gardening. New York: The Macmillan Co., 1914, 2. ed.

Bailey, L. H. The Pruning Book. New York: The Macmillan Co., 1911, 12. ed.

Bailey, L. H. The Principles of Fruit Growing. New York: The Macmillan Co., 1915, rev. ed.

Bailey, L. H. The New Standard Cyclopedia of Horticulture. 6 Vols. New York, The Macmillan Co. Vols. I and II, 1914; Vol. III, 1915; Vols. IV and V, 1916; Vol. VI, 1917.

Bailey, L. H., and Gilbert, A. W. Plant Breeding. New York: The Macmillan Co., 1915, rev. ed.

Brown, R. S. Modern Fruit Marketing. New York: Orange Judd Co., 1917.

Card, F. W. Bush Fruits. New York: The Macmillan Co., 1917, rev. ed.

Davenport, Eugene. Domesticated Annuals and Plants. Boston: Ginn & Co., 1910.

[1] These books are recommended by the Commission on Accredited Schools of the Southern States.

Duggar, B. M. Fungous Diseases of Plants. Boston: Ginn & Co., 1909.
Card, F. W. Bush Fruits. New York: The Macmillan Co., 1914.
Corbett, L. C. Garden Farming. Boston: Ginn & Co., 1914.
Goff, E. S. The Principles of Plant Culture. New York: The Macmillan Co., 1916, rev. ed.
Green, S. B. Popular Fruit Growing. St. Paul, Minn.: Webb Pub. Co., 1912, 4. ed. rev.
Green, S. B. Vegetable Gardening. St. Paul, Minn.: Webb Publishing Co., 1914, 12. ed. rev.
Kains, M. G. Plant Propagation. New York: Orange Judd Co., 1916.
Lloyd, J. W. Productive Vegetable Gardening. Philadelphia: J. B. Lippincott Co., 1914.
Lodeman, E. G. The Spraying of Plants. New York: The Macmillan Co., 1910.
Rexford, E. E. Home Floriculture. New York: Orange Judd Co., 1903.
Rolphs, P. H. Subtropical Vegetable Gardening. New York: The Macmillan Co., 1916.
Sears, F. C. Productive Orcharding. Philadelphia: J. B. Lippincott Co., 1914.
Slingerland, M. V., and Crosby, C. R. Fruit Insects. New York: The Macmillan Co., 1914.
Smith, J. B. Economic Entomology. Philadelphia: J. B. Lippincott Co., 1906.
Watts, R. L. Vegetable Gardening. New York: Orange Judd Co., 1912.
Waugh, F. A. Landscape Gardening. New York: Orange Judd Co., 1912.
Weed, C. M. Farm Friends and Farm Foes. Boston: D. C. Heath & Co., 1910.
White, E. A. Principles of Floriculture. New York: The Macmillan Co., 1915.

OUTLINE FOR RURAL ENGINEERING—FOURTH YEAR.

(One-half unit.)

General references.—How Engineering May Help Farm Life, Yearbook 1915. Laboratory Exercises in Farm Mechanics for Agricultural High Schools, Farmers' Bulletin 638.

FARM MACHINERY.

(24 lessons, 16 exercises.)

LESSON 1.—*Development of Farm Machinery.*

1. History of agriculture in relation to machinery.
2. Development of particular types.
3. Status of American farming in relation to machinery.

LESSON 2.—*Relation of Farm Machinery to Management.*

1. Equipment in relation to type of farming.
2. Equipment in relation to size of farm.
3. Buying machinery.

Special references.—Minor Articles of Farm Equipment, Bureau of Plant Industry, Circular 44. Study of Farm Equipment in Ohio, Bureau of Plant Industry, Bulletin 213.

LESSON 3.—*Mechanical Principles.*

1. Definitions of machine, implement, and tool.
2. Physical principle involved.
3. Factors of efficiency.

LESSONS 4 AND 5.—*Tillage Implements.*

1. Deep tillage implements.
   (*a*) The plow and subsoiler.
2. Shallow tillage implements.
   (*a*) Cultivators, (*b*) harrows, (*c*) the roller and planker, and (*d*) weeders.
3. Hand tools.

Illustrative material.—Catalogues of implement dealers.

EXERCISE 1.—*A Study of Tillage Implements.*

The class may spend the time profitably making a first-hand study of the tillage implements on a well-equipped farm or at an implement dealer's. This exercise should involve the naming of parts as suggested in Exercise 23, Farmers' Bulletin 638.

LESSON 6.—*Fertilizing Machines.*

1. The manure spreader.
2. Machines and devices for spreading commercial fertilizers.
3. Lime-spreading machine.

Special reference.—Farm Methods of Applying Land Plaster in Western Oregon and Western Washington, Bureau of Plant Industry Circular 22.

EXERCISE 2.—*Study and Use of Manure Spreader.*

Arrangements may be made with a near-by farmer so that the students not familiar with a manure spreader may have an opportunity to operate one.

LESSON 7.—*Planting Machines.*

1. Grain drills.
2. Hand drills and seeders.

EXERCISE 3.—*Study and Use of Grain Drill.*

Students who have not used a grain drill should be favored in this practice to be secured on a neighboring farm if the school does not own one. This exercise also may involve the calibration of the grain drill as suggested in Exercise 29, Farmers' Bulletin 638.

LESSON 8.—*Planting Machines*—Continued.

1. Corn planters.
2. Potato planters.
3. Miscellaneous planting devices.

EXERCISE 4.—*Study and Use of Corn-planting Machines.*

Each student should be given an opportunity to become familiar with the types of corn planters most successful in the district. See Farmers' Bulletin 638, Exercise 28, Corn Planter Operation.

LESSON 9.—*Hay-making Machines.*

1. Mowers.
2. Rakes and tedders.
3. Loading, stacking, and storing devices.

LESSON 10.—*Grain-harvesting Machines.*

1. The reaper and self-binder.
2. The header.
3. Corn-harvesting machines.

Special reference.—Corn-harvesting Machinery, Farmers' Bulletin 303.

EXERCISE 5.—*Assembling Mowing Machine and Hay Rake.*

See Farmers' Bulletin 638, Exercise 27, Assembling a Machine.

EXERCISE 6.—*Study of Self Binder.*

LESSON 11.—*Potato and Root Diggers.*

1. Potato diggers.
2. Root diggers.

LESSON 12.—*Thrashing Machines.*

1. The grain separator.
2. Special thrashing machines.
3. The cotton gin.

LESSON 13.—*Machines for Preparing Stock Food and Seeds.*

1. Feed mills, grinders and corn shellers.
2. Ensilage and root cutters.
3. Fanning mills.

EXERCISE 7. *Study and Use of Feed and Fanning Mills.*

This exercise may be carried on most profitably on a neighboring farm or at a feed store.

LESSON 14.—*Farm Conveyances.*

1. Wagons and trucks.
2. Lighter vehicles.

LESSON 15.—*Spraying Machinery.*

1. Hand sprayers.
2. Power sprayers.

EXERCISE 8.—*A Study of Spraying Machinery.*

LESSON 16.—*Power on the Farm.*

1. Elementary principles and definitions.
2. Measurement of power.
3. Transmission of power.

LESSON 17.—*Animals as a Source of Power.*

1. The horse, mule, and the ox.
2. Use of the treadmill.

EXERCISE 9.—*Fitting Collars to Horses or Mules.*

See Farmers' Bulletin 638, Exercise 6, Fitting Collars on Horses.

EXERCISE 10.—*Hitching Three or More Horses or Mules.*

See Farmers' Bulletin 638, Exercise 7, Hitching Up One to Four Horses.

EXERCISE 11.—*Repairing Harness.*

See Farmers' Bulletin 638, Exercise 9, Repair of Harness.

LESSON 18.—*Wind as a Source of Power.*

1. Possibilities.
2. Windmills.

Special reference.—Use of Windmills in Irrigation in the Semiarid West, Farmers' Bulletin 394.

LESSONS 19 AND 20.—*The Gasoline Engine.*

1. Construction.
2. Types of engines.
3. Uses.
4. General problems of operation.

Special reference.—The Use of Alcohol and Gasoline in Farm Engines, Farmers' Bulletin 277.

EXERCISE 12.—*Study of the Gasoline Engine.*

See Farmers' Bulletin 638, Exercise 10, Naming Parts of Gas Engine, and Exercise 11, Wiring Engine.

LESSON 21.—*Stationary Engines and Their Use.*

1. Selecting an engine.
2. Arrangement of mills, etc.
3. Connection of machines.
4. Operation.

EXERCISE 13.—*Use of Gasoline Engine.*

See Farmers' Bulletin 638, Exercise 12, Running Gas Engine, and Exercise 13, Troubles on Gas Engine.

LESSON 22.—*Traction Engines and Automobiles.*

1. Use of the tractor upon the farm.
2. Types of traction engines.
3. The automobile on the farm.

Special references.—Farm Experience with the Tractor, Department Bulletin 174. An Economic Study of the Farm Tractor in the Corn Belt, Farmers' Bulletin 719.

EXERCISES 14 AND 15.—*Study and Use of Automobile.*

Students who know how to operate an automobile should aid the instructor in teaching those not familiar with the machine.

LESSON 23.—*Care of Farm Machinery.*

1. Importance of good care.
2. Details of care.

LESSON 24.—*Repair of Farm Machinery.*

1. The farm shop and its equipment.
2. Utilization of winter season.
3. Importance of supply of extras and repair material.
4. Utilization of material on the farm.

Special reference.—The Repair of Farm Equipment, Farmers' Bulletin 347.

EXERCISE 16.—*Listing Repairs for Old Machinery.*

See Farmers' Bulletin 638, Exercise 26, Making List of Repairs for Machine.

FARM STRUCTURES.

(10 lessons, 6 exercises.)

Reference.—Farm Architecture, Farmers' Bulletin 126.

LESSON 1.—*Use of Cement and Concrete on the Farm.*

1. For what used.
2. Selection of materials.
3. Mixing of materials.

Special references.—The following Farmers' Bulletins: 235, Cement, Mortar, and Concrete; 403, The Construction of Concrete Fence Posts; 461, The Use of Concrete on the Farm.

EXERCISE 1.—*The Mixing and Use of Concrete.*

See Farmers' Bulletin 638, Exercise 16, Concrete Posts, and Exercise 17, Feeding Floor or Sidewalk.

LESSON 2.—*Arrangement of Farm Buildings.*

1. Points to be considered.
2. Suggestive plans.

LESSON 3.—*Building Materials.*

1. Factors affecting choice.
2. Relation of quality to service.
3. Care of farm buildings.
4. Preservative measures and materials.

Special reference.—Use of Paint on the Farm, Farmers' Bulletin 474.

EXERCISE 2.—*Painting and Whitewashing.*

See Farmers' Bulletin 638, Exercise 22, Painting and Whitewashing

LESSON 4.—*The Farmhouse.*

1. Selection of site.
2. Style of architecture.
3. General plans.

LESSON 5.—*The Farmhouse*—Continued.

1. Planning the farmhouse.
2. Modern conveniences for the farm home.

Illustrative material.—Illustrated lecture on Farm Homes, States Relations Service, Office of Farmers' Institutes.

Special references.—Modern Conveniences for the Farm Home, Farmers' Bulletin 270; Comforts and Conveniences in Farmers' Home, Yearbook 1909.

EXERCISE 3.—*Planning Farmhouses.*

Have each student make an individual plan for a farmhouse of medium size.

LESSON 6.—*Barns and Stables.*

1. General barns.
2. The granary.

LESSON 7.—*Barns and Stables*—Continued.

1. The dairy barn.
2. Hog houses and sheep sheds.

Special references.—Designs for Dairy Buildings, Bureau of Animal Industry Circular 131. Hog Houses, Farmers' Bulletin 438.

EXERCISE 4.—*Planning Barns.*

Have each student plan at least one barn.

LESSON 8.—*Poultry Houses.*

1. Types of poultry houses.
2. Plans.
3. Special coops.

Special reference.—Poultry-house Construction, Farmers' Bulletin 574.

EXERCISE 5.—*Making Hog House or Poultry House.*

This may be assigned as a group practicum as suggested in Farmers' Bulletin 638, Exercise 18, Constructing an Individual Hog House, or it may be assigned as an individual home practicum.

LESSON 9.—*Other Buildings.*

1. Implement shed, tool house, shop.
2. Silos.
3. Miscellaneous.

Special references.—The following Farmers' Bulletins: 475, Ice Houses; 589, Home-made Silos.

LESSON 10.—*Farm Fences.*

1. Types of fences.
2. Fence building.
3. Gates.

Special references.—The following Farmers' Bulletins: 239, Corrosion of Fence Wire; 403, The Construction of Concrete Fence Posts.

EXERCISE 6.—*Building a Wire Fence.*

See Farmers' Bulletin 638, Exercise 31, Building a Wire Fence.

FARM SANITATION.

(3 lessons.)

Reference.—Water Supply, Plumbing, and Sewage Disposal for Rural Homes, Department Bulletin No. 57.

LESSON 1.—*Sanitation and Farm Plans.*

1. Importance of sanitation.
2. Relation of sanitation to drainage.
3. Relation of farmhouses to buildings where animals are kept.
4. Relation of mosquitoes and other insects to health.

Illustrative material.—Illustrated lecture on Flies in Relation to Rural Sanitation: States Relations Service. Charts showing relation of flies and mosquitoes to health and other phases of sanitation.

LESSON 2.—*The Water Supply of the Farm.*

1. Importance of pure water.
2. Securing pure water.
3. Water under pressure in buildings.

Illustrative material.—Illustrated lecture on Farm Water Supplies: States Relations Service.

Special references.—The following Farmers' Bulletins: 73, Pure Water on the Farm; 262, Water for Table Use; 296, Wells and a Pure Water Supply; 309, Ice for Household Use. Clean Water and How to Get It on the Farm, Yearbook 1915.

LESSON 3.—*Sewage Disposal.*

1. Importance of proper disposal.
2. Sewage systems and house equipment.
3. Outhouses.

Special references.—The following Farmers' Bulletins: 463, The Sanitary Privy; 527, Sewage Disposal for Rural Homes. Sewage Disposal on the Farm, Yearbook 1916.

AGRICULTURAL SURVEYING.

(3 lessons, 6 exercises.)

LESSON 1.—*Fundamentals of Land Measurement.*

1. Units of measurements.
2. Use and care of instruments.

LESSON 2.—*Field Methods.*

1. Making chain survey.
2. Leveling.

LESSON 3.—*Computing and Map Making.*

1. Making maps.
2. Computing area.

EXERCISE 1.—*Care and Use of Chains and Tapes.*

See Agricultural Engineering, by Davidson, Chapter I.

EXERCISE 2.—*Making a Chain Survey.*

See above reference, Chapter II.

EXERCISE 3.—*Making a Map.*

See above reference, Chapter III.

EXERCISE 4.—*Making and Adjusting a Level.*

See above reference, Chapter VII.

EXERCISE 5.—*Use of Homemade Level.*

See above reference, Chapter VIII.

EXERCISE 6.—*Use of Surveyor's Level.*

See Farmers' Bulletin 63, Exercise 33, Operation of a Level.

FARM DRAINAGE.

(4 lessons, 2 exercises.)

References.—The following department bulletins: 71, The Wet Lands of Southern Louisiana and Their Drainage; 190, The Drainage of Irrigated Lands; 300, Excavating Machinery Used in Land Drainage; 304, Land Drainage by Means of Pumps. The Economy of Farm Drainage, Yearbook 1915. The following Farmers' Bulletins: 524, Tile Drainage on the Farm; 698, Trenching Machinery Used for the Construction of Trenches for Tile Drains.

LESSON 1.—*Importance of Drainage.*

1. Why drainage is necessary.
2. Relation of cost to increased value of land.
3. Lands needing drainage and lands which can be drained.
4. Kinds of drains.

LESSON 2.—*Tile Drainage.*

1. Superiority over other forms.
2. Kinds of tile.
3. Essentials of success in tile drains.
4. Capacity of tile drains.

LESSON 3.—*Laying Out the Drainage System.*

1. Systems of tile drainage.
2. Establishing grades and making maps.

EXERCISE 1.—*Mapping a Drainage System.*

See Farmers' Bulletin 638, Exercise 34, Tile-ditch Profits, and Exercise 35, Setting Up a Gauge Line.

LESSON 4.—*Construction of Tile Drains.*

1. Ditching methods.
2. Laying the tile.

EXERCISE 2.—*Laying Tile.*

See Farmers' Bulletin 638, Exercise 36, Digging Ditch and Laying Tile.

IRRIGATION.

(2 lessons, 1 exercise.)

References.—Irrigation in Humid Climate, Farmers' Bulletin 46. Possibilities and Need of Supplemental Irrigation in the Humid Regions, Yearbook Separate 570.

LESSON 1.—*Relation of Irrigation to Agriculture.*

1. History of irrigation.
2. Present status of irrigation farming.
3. Supplemental irrigation in humid regions.

LESSON 2.—*Practical Irrigation.*

1. Laying out the ditches.
2. Use of water in irrigation.

Special references.—The following Farmers' Bulletins: 138, Irrigation in Field and Garden; 158, How to Build Small Irrigation Ditches; 263, Practical Information for Beginners in Irrigation.

EXERCISE.—*Preparing Garden for Irrigation.*

See Farmers' Bulletin 638, Exercises 38, 39, and 40, Irrigation.

TERRACING.

(2 lessons, 1 exercise.)

Reference.—The Mangum Terrace in Its Relation to Efficient Farm Management, Bureau of Plant Industry Circular 94.

LESSON 1.—*Purposes of Terracing.*

1. Gullying and other forms of erosion.
2. Contours and terraces in ornamental planting and orchards.
3. Types of terraces.

LESSON 2.—*Construction of Terraces.*

1. Laying out contour lines.
2. Use of the A frame and other forms of levels.
3. Making the terrace.

EXERCISE.—*Construction and Use of Terrace Level.*

See Farmers' Bulletin 638, Exercise 37, Laying Out and Building a Terrace.

ROADS.

(3 lessons, 2 exercises.)

References.—The following Farmers' Bulletins: 311, Sand-clay and Burnt-clay Roads; 321, The Use of the Split-log Drag on Earth Roads; 338, Macadam Roads; 505, Benefits of Improved Roads; 597, The Road Drag and How It Is Used.

LESSON 1.—*Importance of Good Roads.*

1. Relation of farming to roads.
2. Financial benefit.
3. Social benefits.

LESSON 2.—*Earth Roads.*

1. Construction of earth roads.
2. Maintenance of earth roads.
3. Use of drag.

LESSON 3.—*Improved Roads.*

1. Use of gravel.
2. Sand clay and burnt clay.
3. Macadam roads.
4. Top soiling.

EXERCISE 1.—*Survey of District Roads and Their Need of Improvement.*

An effort should be made to arouse and maintain community interest in good roads. The students should aid the teacher in making a road survey of the district and in working out a map showing the condition of the roads and bridges.

EXERCISE 2.—*Making and Use of a Drag.*

See Farmers' Bulletin 638, Exercises 41 and 42, Roads.

ROPE WORK.

(1 lesson, 2 exercises.)

LESSON 1.—*Knots and Splices.*

1. Material.
2. Operations.

EXERCISES 1 AND 2.—*Rope Work. Knots and Splices.*

See Farmers' Bulletin 638, Exercises 1, 2, and 3, Rope Work.

SUGGESTIONS FOR PRACTICAL WORK IN RURAL ENGINEERING.

CORRELATIONS.

1. The practical work should be correlated with the work in Mechanic Arts if such a course is given.

2. If a special course in mechanical drawing is not given, it will be well to give a number of lessons in the subject as preparation for the planning of farm buildings and the making of maps.

3. Much of the work may be correlated with mathematics and physics.

EQUIPMENT.

A well-equipped shop, either in connection with the school farm or the work in mechanic arts, will be very useful. Likewise, the equipment of the farm in implements and machinery will be used to good advantage. Where no special equipment is provided, the class should take advantage of the farms of the students, near-by farms, and implement houses. It will be especially important to take advantage of such operation as construction of roads and buildings, thrashing, drainage, or any work connected with the course which may be going on in the vicinity of the school.

COMMUNITY WORK.

Surveys of the community with regard to its use and care of machinery, its sanitary conditions and needs, its roads, water supply, drainage, and irrigation needs, will be of great benefit to the teacher and the class as well as to the community.

PROJECTS.

Wherever it is possible to carry on any extensive practice in connection with the course, either by the class as a whole or by individual students, extra credit should be given for the work. Any of the lines of work suggested below may be either group projects carried on by the class or a number of the students at the school, or upon neighboring farms or individual projects conducted upon the home farm:

Construction of farm buildings.
Construction of walks, feeding floors, etc., of concrete.
Installation of heating, lighting, plumbing, and sewer systems.
Clearing and leveling land.
Laying out irrigation and drainage system.
Terracing.
Road making.
Installing engine and connecting with farm machinery.

TEXTS AND REFERENCES FOR RURAL ENGINEERING.[1]

Benton, M. G. Shop Projects Based on Community Problems. Muncie, Ind.: Vocational Supply Co., 1915.

Blackburn, S. A. Problems in Farm Woodwork. Peoria, Ill.: The Manual Arts Press, 1915.

Bryce, J. M., and Mayne, D. D. Farm Shopwork. New York: The American Book Co., 1915.

Campbell, H. C. Concrete on the Farm and in the Shop. New York: The Norman W. Henley Co., 1916.

Clarkson, R. P. Practical Talks on Farm Engineering. New York: Doubleday, Page & Co., 1915.

Davidson, J. B. Agricultural Engineering. St. Paul, Minn.: Webb Publishing Co., 1913.

Davidson, J. B., and Chase, L. W. Farm Machinery and Farm Motors. New York: Orange Judd Co., 1908.

Exblaw, K. J. T. Farm Structures. New York: The Macmillan Co., 1914.

French, T. E., and Ives, F. W. Agricultural Drawing and the Design of Farm Structures. New York: The McGraw Hill Book Co., 1915.

Fuller, M. L. Domestic Water Supply for the Farm. New York: John Wiley & Sons Co., 1912.

Koester, Frank. Electricity for the Farm and Home. New York: Sturgis & Walton Co., 1913.

Roehl, L. M. Agricultural Woodworking. Milwaukee, Wis.: The Bruce Publishing Co., 1916.

Verrill, A. H. Knots, Splices, and Rope Work. New York: The Norman W. Henley Co., 1916.

[1] These books are recommended by the Commission on Accredited Schools of the Southern States.

OUTLINE FOR RURAL ECONOMICS AND FARM MANAGEMENT—FOURTH YEAR.

(One-half unit, 52 lessons, 36 exercises.)

General references.—A Method of Analyzing the Farm Business, Farmers' Bulletin 661. The following bulletins of the Bureau of Plant Industry: 236, Farm Management; 259, What is Farm Management? Some Outstanding Factors in Profitable Farming. A Graphic Summary of American Agriculture, Yearbook 1915.

LESSON 1.—*Introduction.*

1. Definitions.
2. Relations of agriculture to other industries.

LESSON 2.—*Historical Sketch.*

1. The beginnings of agriculture.
2. Development of modern agriculture.

LESSON 3.—*Farming as a Means of Making a Living.*

1. Comparison with other occupations.
2. Opportunities in agriculture.

LESSON 4.—*Farming as a Mode of Life.*

1. Living in the country.
2. The farm as a home.

LESSON 5.—*Problems of Rural Social Life.*

1. Country life *v.* city life.
2. Factors for social betterment.
3. Personal obligations.

Special references.—Articles in the following Yearbooks: 1914, Organization of a Rural Community; 1915, How the Department of Agriculture Promotes Organization in Rural Life.

LESSON 6.—*City-bred v. Country-bred Farmers.*

1. Advantages of country training.
2. Advantages of city training.
3. The back-to-the-land movement.

Special reference.—Movement of City and Town to Farms, Yearbook 1914.

LESSON 7.—*Farming as a Business.*

1. Comparison with other business.
2. Business principles to be applied.

EXERCISE 1.—*A Suggested Debate.*

Time equal to one laboratory period (a double period) may be spent profitably in a debate involving the question of the relative opportunities for young men in the country and in the city. It will be best to apply the question to the opportunities in the district where the school is located as compared with a neighboring town with which the students are familiar.

LESSON 8.—*The Distribution of Wealth.*

1. Economic principles involved.
2. Relation to use of land.
3. Relation to labor.

LESSON 9.—*Capital.*

1. Relation to type of farming.
2. Farming with small capital.

LESSON 10.—*Rural Credits.*

1. The farmer and the banker.
2. Necessity of good credit.
3. Farm credit systems.
4. The amortization plan.

EXERCISE 2.—*A Suggested Debate.*

Another debate may be introduced at this time to arouse interest in the Federal farm loan act and its application to local conditions. Such a question as "Resolved: That this community (the school district) should organize a local farm-loan association," may fit certain conditions and furnish an excellent means of getting the students to make a survey of local conditions as well as to get a better idea of what the Federal Government has done for the farmer.

Reference material, in addition to that given, may be secured from the Federal Farm Loan Board, Washington, D. C.

Special references.—The following Farmers' Bulletins: 593, How to Use Farm Credit; 654, How Farmers May Improve Their Personal Credit; 792, How the Federal Farm Loan Act Benefits the Farmer.

LESSON 11.—*Land Tenure.*

1. Ownership *v.* rental.
2. Methods of rental.
3. The problem of tenant farming.

Special references.—The following Farmers' Bulletins: 280, A Profitable Tenant Dairy Farm; 437, A System of Tenant Farming and Its Results. The following Department Bulletins: 337, A Study of the Tenant Systems of Farming in the Yazoo and Mississippi Delta; 411, Systems of Renting Truck Farms in Southwestern New Jersey. Causes Affecting Farm Values, Yearbook 1905.

LESSON 12.—*Acquiring Land.*

1. American *v.* European systems.
2. Opportunities for young men.
3. Methods of acquiring land.

LESSON 13.—*Systems of Operation.*

1. Syndicate farming *v.* private ownership.
2. Maintaining fertility *v.* spoliation.

LESSON 14.—*Types of Farming.*

1. Factors which determine type.
2. A comparison of types.

Special reference.—Types of Farming, Yearbook 1908.

LESSON 15.—*General v. Special Farms.*

1. Advantages and disadvantages of general farming.
2. Advantages and disadvantages of special farming.
3. Factors which determine a choice.
4. Present need for diversification in the South.

Special reference.—Diversified Farming Under Plantation System, Farmers' Bulletin 299.

LESSON 16.—*Extensive v. Intensive Farming.*

1. Advantages and disadvantages of extensive farming.
2. Advantages and disadvantages of intensive farming.
3. Factors which determine a choice.

Special references.—Articles in the following Yearbooks: 1902, Systems of Farm Management in the United States; 1905, Diversified Farming in the Cotton Belt; 1908, Causes of Southern Rural Conditions and Small Farm as Important Remedy. The following Farmers' Bulletins: 472, Systems of Farming in Central New Jersey; 519, Example of Intensive Farming in the Cotton Belt.

LESSON 17.—*A Study of Successful Farms—Local.*

1. The farm and what has been accomplished.
2. Factors which have meant success.
3. A local survey.

EXERCISES 3–6.—*Local Farm Surveys.*

Time equal to four double periods should be spent by the students in making an analysis of the home farm business under the direction of the teacher. Directions for this work and suitable forms will be found in Farmers' Bulletin 661, An Analysis of the Farm Business. The teacher may use some of the students in helping him make a general survey of the farms of the community. The results of such a survey will prove invaluable in adapting this course to the needs of the community.

LESSON 18.—*A Study of Successful Farms—General.*

1. The farm and what has been accomplished.
2. Factors which have meant success.
3. General farm surveys.

Special references.—A Model Farm, Yearbook 1903. A Successful Dairy Farm, Bureau of Plant Industry Bulletin 102, part 2. The following Farmers' Bulletins: 242, An Example of Model Farming; 272, A Successful Hog and Seed-corn Farm; 280, A Profitable Tenant Dairy Farm; 310, A Successful Alabama Diversification Farm; 312, A Successful Southern Hay Farm; 355, A Successful Poultry and Dairy Farm; 264, A Profitable Cotton Farm. The following Department Bulletins: 32, An Example of Successful Farm Management in Southern New York; 41, A Farm-management Survey of Three Representative Areas in Indiana, Illinois, and Iowa; 341, Farm-management Practice of Chester County, Pa.; 492, An Economic Study of Farming in Sumter County, Ga.

Problems.—It will be profitable to have the students work out problems in connection with many of the lessons to follow. Those given in Farm Management, by Boss, should be suggestive of others having local application.

LESSON 19.—*Farm Equipment.*

1. Relation of machinery to size of farm and type of farming.
2. First costs and depreciation.
3. Maintenance of equipment.

Special references.—Minor Articles of Farm Equipment, Bureau of Plant Industry Circular 44. A Study of Farm Equipment in Ohio, Bureau of Plant Industry Bulletin 212.

LESSON 20.—*Buying Farm Equipment.*

1. Local dealers *v.* mail-order houses.
2. Cash payment *v.* credit.
3. Cooperation in buying.

LESSON 21.—*Increasing Production.*

1. Relation of acre yield to profit.
2. Relation of production to prices.
3. Factors in crop increase.

LESSON 22.—*Maintenance of Fertility.*

1. Obligations to coming generation.
2. Ways of increasing productivity.
3. Relation to farm management.
4. Restoring lost fertility.
5. Preventing erosion.

Special references.—The Mangum Terrace in Its Relation to Efficient Farm Management, Bureau of Plant Industry Circular 94. Also, the following Farmers' Bulletins: 257, Soil Fertility; 326, Building up a Run-down Cotton Plantation.

LESSON 23.—*Live Stock and Soil Fertility.*

1. Animal products *v.* plant products in relation to plant food.
2. Value of barnyard manure.
3. Care and use of barnyard manure.

Special references.—The Function of Live Stock in Agriculture, Yearbook 1916. The following Farmers' Bulletins: 192, Barnyard Manure; 614, A Corn-belt Farming System Which Saves Harvest Labor by Hogging Down Crops; 704, Grain Farming in the Corn Belt with Live Stock as a Side Line.

LESSON 24.—*Economics of Animal Production.*

1. Live stock as a means of marketing low-priced crops.
2. Live stock and cheap labor.
3. Relation of live stock to type of farming and size of farm.

Special reference.—Cropping Systems for Stock Farms, Yearbook 1907.

LESSON 25.—*Some Live-Stock Problems.*

1. Pure-bred *v.* grade stock.
2. Breeding animals *v.* market stock.
3. Depreciation and increase in value of stock.

Special references.—The following department Bulletins: 49, The Cost of Raising a Dairy Cow; 413, Influence of Age on the Value of Dairy Cows and Farm Work Horses.

LESSON 26.—*Rotation of Crops.*

1. Benefits of crop rotation.
2. Essentials of a good system.

LESSON 27.—*Rotation of Crops*—Continued.

1. Classification of crops.
2. General rotations.

LESSON 28.—*Rotation of Crops*—Continued.

1. Rotations for the cotton belt.
2. Rotations for special farms.

Special references.—Suggested Cropping System for the Black Lands of Texas, Bureau of Plant Industry Circular 84. Planning Cropping Systems, Bureau of

Plant Industry Bulletin 102, Part 3. Articles in the following Yearbooks: 1905, Diversified Farming in the Cotton Belt; 1907, Cropping Systems for Stock Farms; 1911, Rotations in the Corn Belt. Diversified Farming under the Plantation System, Farmers' Bulletin 299.

LESSON 29.—*Planning the Farm and Farmstead.*

1. Need of careful planning.
2. Size of farms.
3. Eliminating waste land.

Special reference.—Waste Land and Wasted Land on Farms, Farmers' Bulletin 745.

LESSON 30.—*Planning the Farm and Farmstead*—Continued.

1. Size and shape of fields.
2. Relation of field to farmstead.

LESSON 31.—*Planning the Farm and Farmstead*—Continued.

1. Relation of farms to highways.
2. Laying out the farm.

Special reference.—A Model Farm, Yearbook, 1903.

LESSON 32.—*Planning the Farm and Farmstead*—Continued.

1. The farm house.
2. Other farm buildings.
3. Arrangement of buildings.

EXERCISES 7–10.—*Drafting Farm Plans.*

Four double periods should be spent in drafting and in a critical examination of farm plans by the students. Such plans should include the home farms of the students and ideal plans of such types of farms as the individual students have a special interest in. The plans should be drawn to scale and traced with ink. Such a grade of work should be required that the students will desire to keep the plans.

LESSON 33.—*Replanning Problems.*

1. A study of replanned farms.

LESSON 34.—*Replanning Problems*—Continued.

1. Replanning the farmstead.
2. Remodeling of buildings.

LESSON 35.—*Replanning Problems*—Continued.

1. Rearrangement of local farms.
2. Rearrangement of local farmsteads.

EXERCISES 11–14.—*Replanning Problems.*

After the students have had general practice in making farm plans four double periods may be spent profitably in replanning farms and farmsteads of the community.

Special reference.—Replanning a Farm for Profit, Farmers' Bulletin 370.

LESSON 36.—*Farm Labor.*

1. Why there is a labor problem.
2. Kinds of farm labor.
3. The tenant problems.

LESSON 37.—*Management of Farm Labor.*

1. A day's work for one man.
2. Efficiency in management.
3. Seasonal distribution.

Special references.—The following department bulletins: 3, Normal Day's Work for Various Farm Operations; 412, The Normal Day's Work of Farm Implements, Workmen, and Crews in Western New York. Articles in the following Yearbooks: 1910, Supply and Wages of Farm Labor; 1911, Seasonal Distribution of Labor on the Farm.

EXERCISES 15 AND 16.—*Planning Work Schedules.*

After the work with farm plans two double periods should be taken in planning work schedules for the home farms of the students and other farms which they have planned and in which they have an interest.

LESSON 38.—*Factors of Agricultural Production.*

1. Land.
2. Capital goods.
3. Population.

LESSON 39.—*Cost of Production.*

1. Necessity of knowing costs.
2. Factors which determine cost.
3. Interest on permanent investment and depreciation.

EXERCISES 17–20.—*Cost of Production.*

Time equal to four double periods should be spent in working out costs of production on local farms. Records kept in connection with home projects and club work may form the basis of this work.

Special reference.—Farm Records and Accounts—Suggestions for Teaching the Subject in Secondary Schools, States Relations Service Document 38.

LESSON 40.—*Cost of Production*—Continued.

1. Cost of man labor and horse labor.
2. Cost of live-stock production.
3. Contribution of farm to farmer's living.
4. Wastes of the farm.

Special references.—The following Farmers' Bulletins: 635, What the Farm Contributes Directly to the Farmer's Living; 746, The Farmer's Income. The following bulletins of the Bureau of Statistics, United States Department of Agriculture: 16, Cost of Cotton Production; 48, Cost of Producing Minnesota Farm Products; 73, Cost of Producing Farm Products; 88, Cost of Producing Minnesota Dairy Products. The following Department Bulletins: 29, Crew Work Costs and Returns in Commercial Orcharding in West Virginia; 49, The Cost of Raising a Dairy Cow; 130, Operating Cost of a Well-established New York Apple Orchard; 321, Cost of Fencing Farms in North Central States; 338, Machinery Cost of Farm Operations in Western New York; 410, Value to Farm Families of Food, Fuel, and Use of Home; 446, Cost of Producing Apples in Wenatchee Valley, Wash.

EXERCISES 21–26.—*Farm Bookkeeping.*

In connection with the general lessons in farm accounts time equal to six double periods should be given to practice in the application

of the general principles of bookkeeping to farm accounts. Stress should be placed upon forming habits of neatness and accuracy.

LESSON 41.—*Farm Records and Accounts.*

1. Necessity of farm records and accounts.
2. Essentials of a farm-account system.

Special references.—The following Farmers' Bulletins: 511, Farm Bookkeeping; 572, A System of Farm Cost Accounting; 661, An Analysis of the Farm Business; 782, The Use of a Dairy for Farm Accounts.

LESSON 42.—*Farm Records and Accounts*—Continued.

1. Kinds of accounts.
2. Personal accounts.

EXERCISES 27–32.—*Home Farm Records.*

Time equal to six double periods should be spent in applying the principles of farm bookkeeping to home records and accounts. The needs brought out in an analysis of the farm business should form a basis for this work.

LESSON 43.—*Farm Records and Accounts*—Continued.

1. General accounts.
2. The farm inventory.

EXERCISES 33 AND 34.—*Farm Inventories.*

In connection with the farm accounting two double periods should be spent in taking inventories on the home farm or representative farms in the school district.

LESSON 44.—*Farm Records and Accounts*—Continued.

1. Receipts and expenses.
2. Miscellaneous accounts.

LESSON 45.—*Farm Records and Accounts*—Continued.

1. Field accounts.
2. Labor accounts.

LESSON 46.—*Farm Records and Accounts*—Continued.

1. Animal-husbandry accounts.
2. Animal-husbandry records.
3. Animal-breeding records.

LESSON 47.—*Marketing Farm Products.*

1. Selling at harvest time.
2. Storing for higher prices.

Special references.—The following Farmers' Bulletins: 764, Cotton Ginning Information for Farmers; 775, Losses From Selling Cotton in the Seed. Disadvantages of Selling Cotton in the Seed, department bulletin 375.

LESSON 48.—*Marketing Farm Products*—Continued.

1. Wholesale *v.* retail.
2. Selling on commission.
3. Advertising.
4. Using the parcel post.

Special references.—The following department bulletins: 266, Outlets and Methods of Sale for Shippers of Fruits and Vegetables; 267, Methods of Wholesale Distribution of Fruits and Vegetables on Large Markets; 315, Cantaloup Marketing in the Larger Cities, With Car-lot Supply, 1914; 331, The Handling and Shipping of Fresh Cherries.

and Prunes from the Willamette Valley. Articles in the following Yearbooks: 1904, Consumers' Fancies; 1911, Handling and Marketing Eggs; 1912, Improved Methods of Handling and Marketing Cotton. Economics of Crop Disposal, Bureau of Plant Industry Bulletin 118. The following Farmers' Bulletins: 62, Marketing Farm Produce; 703, Suggestions for Parcel-post Marketing.

LESSON 49.—*Cooperation in Agriculture.*

1. Need of cooperation.
2. Methods of cooperation.
3. What has been accomplished.

Special references.—Cooperative Organization Business Methods. Department bulletin 178. Articles in the following Yearbooks: 1910, Cooperation in Handling and Marketing Fruits; 1913, Organization of Rural Interests; 1914, Cooperative Marketing and Financing of Marketing Associations; 1914, How the Department of Agriculture Promotes Organization in Rural Life; 1915, The Cooperative Purchase of Farm Supplies. Cooperative Live-stock Shipping Associations, Farmers' Bulletin 718.

LESSON 50.—*Choosing a Region.*

1. Consideration of climate, soil, etc.
2. Type of farming.

Special reference.—Opportunities in Agriculture, Yearbook 1904

LESSON 51.—*Choosing a Farm.*

1. Importance of careful consideration.
2. Characteristics of community.

LESSON 52.—*Choosing a Farm*—Continued.

1. Characteristics of the farm.
2. Fitting a farm to personal ideals and circumstances.

EXERCISES 35 AND 36.—*Scoring Farms.*

Two double periods should be spent in scoring farms in the community and determining their value. Preference should be given farms for sale.

Special references.—How to Choose a Farm, by Hunt, and Farm Management, by Boss, have suggestive score cards.

HOME PROJECTS IN RURAL ECONOMICS AND FARM MANAGEMENT.

No definite time and credit for home projects is suggested for this course, as a half year is a limited time in which to cover the subject, and the home work in farm management is such that time and credit must be adjusted to fit individual students. Effort should be made, however, to link practical work in farm management at home with the work of the school and to encourage such work by giving extra credit.

Work in connection with the keeping of farm records and accounts and the making of community surveys may be made extensive enough to consider a project which would be worthy of extra credit. Wherever students have the general management of a farm or any extensive phase of the farm work, an effort should be made to connect this work in such a way with the course in farm management that it will be worthy of school credit. Such work should offer an excellent opportunity to apply the principles brought out in the classroom.

TEXTS AND REFERENCES FOR RURAL ECONOMICS AND FARM MANAGEMENT.[1]

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Carver, T. N. Principles of Rural Economics. Boston: Ginn & Co., 1911.

Carver, T. N. Selected Readings in Rural Economics. Boston: Ginn & Co., 1916.

Coulter, J. L. Cooperation Among Farmers. New York: Sturgis Walton Co., 1911.

Hunt, T. F. How to Choose a Farm. New York: The Macmillan Co., 1911, 2. ed.

Nourse, E. G. Agricultural Economics. Chicago: University of Chicago Press, 1916.

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Powell, G. H. Cooperation in Agriculture. New York: The Macmillan Co., 1913.

Sanford, A. H. The Story of Agriculture in the United States. Boston: D. C. Heath & Co., 1916.

Steiner, H. L. How to Keep Farm Accounts. Toledo, Ohio: Author, 1912.

Taylor, H. C. An Introduction to the Study of Agricultural Economics. New York: The Macmillan Co., 1914.

Vye, J. A. Farm Accounts. St. Anthony Park, Minn.: Author, 1906.

Warren, G. F. Farm Management. New York: The Macmillan Co., 1913.

Warren, G. F., and Livermore, K. C. Laboratory Exercises in Farm Management. New York: The Macmillan Co., 1913.

Weld, L. D. H. The Marketing of Farm Products. New York: The Macmillan Co., 1916.

[1] These books are recommended by the Commission on Accredited Schools of the Southern States.

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